NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

Waste Storage Facility
(No.)
No. 313

Definition

A waste storage impoundment made by constructing an embankment and/or excavating a pit or dugout, or by fabricating a structure.

Purpose

To temporarily store wastes such as manure, wastewater, and contaminated runoff as a storage function component of an agricultural waste management system.

Conditions Where Practice Applies

- where the storage facility is a component of a planned agricultural waste management system
- where temporary storage is needed for organic wastes generated by agricultural production or processing
- where the storage facility can be constructed, operated and maintained without polluting air or water resources
- where site conditions are suitable for construction of the facility
- to facilities utilizing embankments with an effective height of 35 feet or less where damage resulting from failure would be limited to damage of farm buildings, agricultural land, or township and country roads
- to fabricated structures including tanks, stacking facilities, and pond appurtenances

Federal, State, and Local Laws[1]

Design and construction activities shall comply with all federal, state, and local laws, rules, and regulations governing pollution abatement, health, and safety. The owner or operator shall be responsible for securing all required permits or approvals and for performing in accordance with such laws and regulations. NRCS employees are not to assume responsibility for procuring these permits, rights, or approvals, or for enforcing laws and regulations. NRCS may provide the landowner or operator with technical information needed to obtain the required rights or approvals to construct, operate, and maintain the practice.

Permits may be required from the following agencies:

1. ***West Virginia Department of Health***
2. ***West Virginia Department of Agriculture***

Planning Considerations

Water Quantity

1. Effects on the water budget, especially on volumes and rates of runoff, including snow melt, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.
2. Variability caused by seasonal climatic changes.
3. Effects of the operations and maintenance demands on the water supply of the site.

Water Quality

1. Effects on erosion and the movement of sediment, pathogens, and soluble and sediment-attached substances carried by runoff.

2. Effects of nutrients on surface and ground water quality, particularly the on-site water supply for human and livestock consumption.

3. Effects on the visual quality of on-site and downstream water resources.

4. Short-term and construction-related effects on the quality of downstream surface and ground water.

5. The effects on wetlands and water-related wildlife habitats.

Engineer's Report

An engineer's report shall be prepared for the proposed installation. The report shall include, as a minimum, the following items:

Number of animals.

Size and kind of animals.

Future expansion (negative documentation required).

Documentation of dwellings within 1,000 feet of the facility.

Geologic/soils investigation and site interpretations.

Determination if site is in a 25-year, 24-hour frequency floodplain. (Negative documentation required).

Type of facility being designed.

Describe measures taken to prevent unpolluted surface runoff from entering facility.

Required service life for the structure, as requested by the operator.

Design Criteria

General Criteria Applying to All Waste Storage Facilities

Visual impact. ***Facilities should be screened by vegetative plantings, or other methods, to shield the facility from public view and improve visual quality.***

Location. To minimize the potential for contamination of streams, waste storage facilities should be located outside of floodplains. However, if site restrictions require location within a floodplain, they shall be protected from inundation or damage from a 25-year flood event, or larger if required by laws, rules, and regulations. Waste storage facilities shall be located so the potential impacts from breach of embankment, accidental release, and liner failure are minimized; and separation distances are such that prevailing winds and landscape elements such as building arrangement, landforms, and vegetation minimize odors and protect aesthetic values.

Storage period. The storage period is the maximum length of time anticipated between emptying events. The minimum storage period shall be based on the timing required for environmentally safe waste utilization considering the climate, crops, soil, equipment, and local, state, and federal regulations. ***For West Virginia, 90 days is recommended as the minimum storage period. In no case will the storage period be less than 60 days.***

Design storage volume. The design storage volume equal to the required storage volume, shall consist of the total of the following as appropriate:

a. Manure, wastewater, and other wastes accumulated during the storage period.

b. Normal precipitation less evaporation on the surface area (at the design storage volume level) of the facility during the storage period.

c. Normal runoff from the facility's drainage area during the storage period.

d. 25-year, 24-hour precipitation on the surface (at the required design storage volume level) of the facility.

e. 25-year, 24-hour runoff from the facility's drainage area.

f. Residual solids after liquids have been removed. A minimum of 6 inches shall be provided for tanks ***and ponds.***

g. Additional storage as may be required to meet management goals or regulatory requirements.

Determination of waste volume per day shall be based on actual waste production. The following table presents the daily manure production from farm animals. This shall be used as a minimum for design purposes.

Daily Manure Production (Feces and Urine)

Kind of Animal	***Volume (cubic feet per day per 1000 lbs. of animal weight)***
Dairy cattle	***1.4***
Beef cattle	***1.1***
Horse	***1.0***
Swine	***1.3***
Sheep	***0.6***
Poultry	***1.0***

When bedding is used for management purposes, the total manure production shall be increased by the actual volume of the bedding, or 30 percent if the bedding volume is not known.

Wash water and other wastes from milking parlors may be measured to determine an accurate volume, or an average figure of 0.7 cubic foot (5 gallons) per day per cow milked can be used. Required dilution water for pumping purposes shall be calculated and storage provided. Solid content for pumping shall not exceed 12 percent.

Inlet. Inlets shall be of any permanent type designed to resist corrosion, plugging, freeze damage and ultraviolet ray deterioration while incorporating erosion protection as necessary.

Pipe inlets may be steel, concrete, PVC, or aluminum, as required by the West Virginia Standard for Ponds (378) for the various depths of cover. However, if corrugated steel pipe is used, it will be protected by Class B (fully bituminous coated), or Class P (polymer coated) as specified in ASTM A 849. When coating P is to be used, coating on inside only may be used if the outside of the pipe will not be in direct contact with the wastes; otherwise, coating on both sides will be used. Corrugated steel pipe with a PVC liner is also acceptable. Polyvinyl chloride pipe shall meet the requirements of Construction Specification 711. Depth of fill over PVC pipe shall not exceed 10 feet. The diameter of PVC pipes shall not exceed 18 inches.

All pipes will be designed to carry the required flow. Pipes with gravity flow for liquids only shall be 6 inches minimum diameter and for gravity loading of solids and liquids shall be 18 inches minimum diameter for smooth interior pipe and 24 inches minimum diameter for corrugated pipe. Pumped inlets shall be sized to meet the requirements of the pumping equipment.

Gravity flow pipe inlets for liquids only may outlet at or above the design volume elevation. The slope of the pond at the pipe outlet shall be protected from erosion by paving or by extending the pipe outlet to a point where discharge will not fall on the slope. Pipes will be supported on piers of pressure-treated wood, steel, concrete, or masonry and anchored to prevent dislodging by ice, wind, or flotation.

Large diameter gravity loading pipes for solids and liquids shall outlet at the bottom of the pond, and the effective head (vertical difference between top of drop inlet and design volume elevations) shall be no less than 4 feet. Alignment and grade shall be as straight as possible and no alignment change will be greater than 45 degrees. Drop structures for these type inlets shall be wide enough to accommodate the scraping equipment and shall have a volume equal to or greater than the waste production for one-half day. A solid or grated cover adequate to support the required loads shall be provided on drop structures. Drop structures in series

may be used to accommodate cleaning operations. If wash water is to enter the system through the drop structures, it should be added through the uppermost drop structure.

Emptying Components. Some type of component shall be provided for emptying storage facilities. It may be a facility such as a gate, pipe, dock, wet well, pumping platform, retaining wall, or ramp. Features to protect against erosion, tampering, and accidental release shall be incorporated as necessary.

Accumulated solids removal. Provisions shall be made for periodic removal of accumulated solids to preserve storage capacity. The anticipated method for doing this must be considered in planning, particularly in determining the configuration of ponds and type of seal, if any.

Safety. Design shall include appropriate safety features to minimize the hazards of the facility. Ramps used to empty liquids shall have a slope of 4 horizontal to 1 vertical or flatter. Those used to empty slurry, semi-solid, or solid waste shall have a slope of 10 horizontal to 1 vertical or flatter unless special traction surfaces are provided. Warning signs, fences, ladders, ropes, bars, rails, and other devices shall be provided, as appropriate, to ensure the safety of humans and livestock. Ventilation and warning signs must be provided for covered waste holding structures, as necessary, to prevent explosion, poisoning, or asphyxiation. Pipelines shall be provided with a water-sealed trap and vent, or similar device, if there is a potential, based on design configuration, for gases to enter buildings or other confined spaces. Ponds and uncovered fabricated structures for liquid or slurry waste with walls less than 5 feet above ground surfaces shall be fenced and warning signs posted to prevent children and others from using them for other than their intended purpose.

Erosion protection. Embankments and disturbed areas surrounding the facility shall be treated to control erosion.

Roof drains shall be constructed on barns and other buildings to prevent this runoff from becoming polluted. Maximum use shall be made of diversions to intercept and divert surface runoff before it reaches the waste area. Measures used to divert runoff shall be designed to safely handle at least a 25-year, 24-hour storm.

Liners. Liners shall meet or exceed the criteria in NRCS Practice Standard 521, Pond Sealing or Lining.

Additional Criteria for Waste Storage Ponds

Location. ***Waste storage ponds should be located a minimum of 1,000 feet from any neighboring residences. If this is not possible, the landowner shall obtain written easements from the affected neighbors. However, waste storage ponds shall not be located within 300 feet of any neighboring residence or any public water source.***

Soil and foundation. The pond shall be located in soils with an acceptable permeability, that meets all applicable regulation, or the pond shall be lined. Information and guidance on controlling seepage from waste impoundments can be found in the Agricultural Waste Management Field Handbook (AWMFH), Appendix 10D.

The pond shall have a bottom elevation that is a minimum of 2 feet above the seasonal high water table unless features of special design are incorporated that address buoyant forces, pond seepage rate and non-encroachment of the water table by contaminants. The water table may be lowered by use of perimeter drains, if feasible, to meet this requirement.

Maximum Operating Level. The maximum operating level for waste storage ponds shall be the pond level that provides for the required volume less the volume contribution of precipitation and runoff from the 25-year, 24-hour storm event plus the volume allowance for residual solids after liquids have been removed. A permanent marker or recorder shall be installed at this maximum operating level to indicate when drawdown should begin. The marker or recorder shall be referenced and explained in the O&M plan.

Outlet. No outlet shall automatically release storage from the required design volume. Manually operated outlets shall be of permanent type designed to resist corrosion and plugging.

<u>For ponds with drainage areas.</u> An emergency spillway, combination of spillways, or additional storage shall be provided to protect the facility from overtopping during a 25-year, 24-hour storm occurring when the design volume is full. The crest elevation of all spillway combinations shall be set at the design volume elevation.

If an excavated emergency spillway is installed, it will be constructed in undisturbed earth. The spillway will have minimum dimensions of 1.0 foot in depth and 8 feet in width. Side slopes of the spillway shall be no steeper than 2:1. No additional freeboard is required.

<u>For ponds without drainage area.</u> The pond shall be protected from overtopping by adding 1 foot to the design volume elevation to set the top of embankment.

Pipe emergency spillways shall be 6 inch minimum diameter and equipped with trash racks, antivortex devices, and seepage control as provided in West Virginia Standard for Ponds (378). Pipes may be steel, aluminum, concrete, or PVC as required by West Virginia Standard for Ponds (378) for the various depths of cover.

Embankments. The minimum elevation of the top of the settled embankment shall be 1 foot above the waste storage pond's required volume. This height shall be increased by the amount needed to ensure that the top elevation will be maintained after settlement. This increase shall be not less than 5 percent. The minimum top widths are shown in Table 1. The combined side slopes of the settled embankment shall be not less than 5 horizontal to 1 vertical, and neither slope shall be steeper than 2 horizontal to 1 vertical unless provisions are made to provide stability.

Table 1 – Minimum Top Widths

Total embankment Height, ft.	Top Width, ft.
15 or less	8
15 – 20	10
20 – 25	12
25 – 30	14
30 – 35	15

Excavations. Unless supported by a soil investigation, excavated side slopes shall be no steeper than 2 horizontal to 1 vertical.

Emptying facilities. ***To minimize frequency of solids removal from wastewater and runoff storage ponds, the flow may be directed through a settling basin or low velocity channel designed in accordance with the Standard for Filter Strip (393).***

A solids separator may also be used to remove fibrous solids from wastewater to facilitate pumping and irrigation.

Waste shall be removed from storage and used or disposed of at locations, times, rates, and volumes shown in a waste utilization plan, without polluting the surface or ground water. Waste may be liquid, slurry, or solid, and proper equipment must be available to remove and apply it to the land.

Solids and slurries may be removed by tractor and loader bucket with conventional spreading on fields. If this method is used, a paved entrance ramp and bottom will have curbs installed to prevent cutting into the earth slopes during cleaning. Curbs may be concrete as detailed on drawing No. WV-ENG-53, Concrete Details, or 6-inch by 6-inch pressure-treated wood with 1/2-inch-diameter anchor bolts at 4 feet center-to-center maximum.

Slurries and liquids may be removed by pumping or gravity flow and disposed of by spreading with liquid tank wagons or through irrigation.

When pumping is the selected method of waste removal, proper facilities for use of the available equipment will be designed. No special facility will be needed when pumping equipment can be operated from the top of the earth embankment or cut slope. Periodic residual solids removal can be accomplished by recirculation and agitation or with equipment such as a track-mounted endloader, which can be safety operated on embankment or cut slopes.
Gravity unloading can be used for systems that contain liquids or slurries. All gravity systems will be equipped with two gates or valves to insure that accidental unloading does not occur due to failure of one gate or

valve. Gates and valves will be constructed of materials suitable for the conditions and designed to withstand the required heads. When a portion of the unloading pipe will be above ground, the first gate or valve will be installed in a dry well or pit, protected from freezing, to facilitate draining of the portion of exposed pipe and eliminate freezing problems. The type of pipe will be the same as required for gravity inlet pipes.

Pond bottoms for gravity systems shall slope at 2 percent or greater toward the outlet pipe, and the pipe shall be recessed approximately one-half of its diameter below the pond bottom to facilitate complete emptying of the pond. A 4-inch-thick concrete apron shall be provided at the unloading pipe inlet. It shall extend a minimum distance equivalent to five pipe diameters into the pond, be equivalent to three pipe diameters in width, and extend up the slope and around the pipe to a point 1 foot in elevation above the top of the pipe.

Pipe size for liquid systems shall be based on the unloading time required and the requirements of pressure and flow rate required for irrigation equipment when it is used. When solids are not removed through a sediment basin or low velocity channel prior to entering the pond, the minimum pipe size will be 6 inches in diameter.

Gravity unloading pipes for slurries shall be of the same sizes and kinds as required for gravity inlet pipes.

Gravity unloading pipes for loading into tank spreaders will be supported on piers or retaining walls adequate to support the loads.

A free-draining paved slab shall be provided at the discharge point of gravity unloading pipes of such size to accommodate the tank spreader, but shall be no smaller than 10 feet by 10 feet.

Disposal areas for application of both liquids and solids shall be designated in an overall waste utilization plan. They shall be accessible when needed, contain suitable soils, and be of sufficient size to safely assimilate all wastes. Rates and volumes of application shall be determined on the basis of soil, site, and crop conditions to prevent pollution of surface or ground water. When irrigation is being considered, the application rates and volumes shall meet State Department of Health requirements.

Additional Criteria for Fabricated Structures

Service life. The structure shall be constructed of materials which will provide the needed service life. A minimum service life of 10 years shall be designed.

Service Life	***Material***
Short (10 to 19 years)	***Wood, masonry, other performance-proven materials***
Medium (20 to 49 years)	***Reinforced concrete, glass-fused steel***
Long (Over 50 years)	***Reinforced concrete***

Foundation. The foundations of fabricated waste storage structures shall be proportioned to safely support all superimposed loads without excessive movement or settlement.

Where a non-uniform foundation cannot be avoided or applied loads may create highly variable foundation loads, settlement should be calculated from site specific soil test data. Index tests of site soil may allow correlation with similar soils for which test data is available. If no test is available, presumptive bearing strength values for assessing actual bearing pressures may be obtained from Table 2 or another nationally recognized building code. In using presumptive bearing values, adequate detailing and articulation shall be provided to avoid distressing movements in the structure.

Foundations consisting of bedrock with joints, fractures, or solution channels shall be treated or a separation distance provided consisting of a minimum of 1 foot of impermeable soil between the floor slab and the bedrock or an alternative that will achieve equal protection.

Liquid Tightness. Applications such as tanks, that require liquid tightness shall be designed and constructed in accordance with standard engineering and industry practice appropriate for

the construction materials used to achieve this objective.

Table 2 - Presumptive Allowable Bearing Stress Values[1]

Foundation Description	Allowable Stress
Crystalline Bedrock	12000 psf
Sedimentary Rock	6000 psf
Sandy Gravel or Gravel	5000 psf
Sand, Silty Sand, Clayey Sand, Silty Gravel, Clayey Gravel	3000 psf
Clay, Sandy Clay, Silty Clay, Clayey Silt	2000 psf

[1] Basic Building Code, 12th Edition, 1993, Building Officials and Code Administrators, Inc. (BOCA)

Structural loadings. Waste storage structures shall be designed to withstand all anticipated loads including internal and external loads, hydrostatic uplift pressure, concentrated surface and impact loads, water pressure due to seasonal high water table, and frost or ice pressure and load combinations in compliance with this standard and applicable local building codes.

The lateral earth pressures should be calculated from soil strength values determined from the results of appropriate soil tests. Lateral earth pressures can be calculated using the procedures in TR-74. If soil strength tests are not available, the presumptive lateral earth pressure values indicated in Table 3 shall be used.

Lateral earth pressures based upon equivalent fluid assumptions shall be assigned according to the following conditions:

- **Rigid Frame or restrained wall.** Use the values shown in Table 3 under the column "Frame Tanks" which gives pressures comparable to the at-rest condition.

- **Flexible or yielding wall.** Use the values shown in Table 3 under the column "Freestanding Wall," which gives pressures comparable to the active condition. Walls in this category are designed on the basis of gravity for stability or are designed as a cantilever having a base wall thickness to height of backfill ratio not more than 0.085.

Internal lateral pressure used for design shall be 65 lbs/ft^2 where the stored waste is not protected from precipitation. A value of 60 lbs/ft^2 may be used where the stored waste is protected from precipitation and will not become saturated. Lesser values may be used if supported by measurement of actual pressures of the waste to be stored. If heavy equipment will be operated near the wall, an additional two feet of soil surcharge shall be considered in the wall analysis.

Tank covers shall be designed to withstand both dead and live loads. The live load values for covers contained in ASAE EP378.3, Floor and Suspended Loads on Agricultural Structure Due to Use, and in ASAE EP393.2, Manure Storages, shall be the minimum used. The actual axle load for tank wagons having more than a 2,000 gallon capacity shall be used.

If the facility is to have a roof, snow and wind loads shall be as specified in ASAE EP288.5, Agricultural Building Snow and Wind Loads. If the facility is to serve as part of a foundation or support for a building, the total load shall be considered in the structural design.

Structural design. The structural design shall consider all items that will influence the performance of the structure, including loading assumptions, material properties and construction quality. Design assumptions and construction requirements shall be indicated on standard plans.

Tanks may be designed with or without covers. Covers, beams, or braces that are integral to structural performance must be indicated on the construction drawings. The openings in covered tanks shall be designed to accommodate equipment for loading, agitating, and emptying. These openings shall be equipped with grills or secure covers for safety, and for odor and vector control.

Table 3 - Lateral Earth Pressure Values[1]

Soil		Equivalent Fluid Pressure (lb/ft^2 /ft of depth)			
Description[4]	Unified Classification[4]	Above seasonal high water table[2]		Below seasonal high water table[3]	
		Free-standing wall	Frame tanks	Free-standing wall	Frame tanks
Clean gravel, sand or sand-gravel mixtures (maximum 5% fines).[5]	GP, GW, SP, SW	30	50	80	90
Gravel, sand, silt and clay mixtures (less than 50% fines), Coarse sands with silt and/or clay (less than 50% fines).	All gravel/sand dual symbol classifications and GM, GC, SC, SM, SC-SM	35	60	80	100
Low-plasticity silts and clays with some sand and/or gravel (50% or more fines), Fine sands with silt and/or clay (less than 50% fines).	CL, ML, CL-ML SC, SM, SC-SM	45	75	90	105
Low to medium plasticity silts and clays with little sand and/or gravel (50% or more fines).	CL, ML, CL-ML	65	85	95	110
High plasticity silts and clays (liquid limit more than 50).[6]	CH, MH	--	--	--	--

[1]For lightly compacted soils (85% to 90% maximum standard density.) Includes compaction by use of typical farm equipment.
[2]Also below seasonal high water table if adequate drainage is provided.
[3]Includes hydrostatic pressure.
[4]All definitions and procedures in accordance with ASTM D 2488 and D 653.
[5]Generally, only washed materials are in this category.
[6]Not recommended. Requires special design if used.

All structures shall be underlain by free draining material or shall have a footing located below the anticipated frost depth. Fabricated structures shall be designed according to the criteria in the following references as appropriate:

- Steel. "Manual of Steel Construction", American Institute of Steel Construction.
- Timber. "National Design Specifications for Wood Construction", American Forest and Paper Association.
- Concrete. "Building Code Requirements for Reinforced Concrete, ACI 318", American Concrete Institute.
- Masonry. "Building Code Requirements for Masonry Structures, ACI 530", American Concrete Institute.
- ***Coatings. National Engineering Manual 210-512.20 to 512.23.***
- ***Glass-fused Steel. National Engineering Manual 210-512.20 to 512.23.***
- ***Expansion Joint. Preformed bituminous 1/2-inch thick joint filler.***
- ***Waterstops. Shall be non-metallic and conform to NEH-20 Material Specification 537.***

Standard designs exhibited in the Agricultural Waste Management Field Handbook, Chapter 12, and the West Virginia Supplement to Chapter 6 of the Engineering Field Handbook may be used. If the proposed structure exceeds any of the criteria in a standard design, a site specific design must be prepared. Site specific designs shall be based on the loadings and criteria given in this Standard.

Slabs on grade. Slab design shall consider the required performance and the critical applied loads along with both the subgrade material and material resistance of the concrete slab. Where applied point loads are minimal and liquid-tightness is not required, such as barnyard and feedlot slabs subject only to precipitation, and the subgrade is uniform and dense, the minimum slab thickness shall be 4 inches with a maximum joint spacing of 10 feet. Joint spacing can be increased if steel reinforcing is added based on subgrade drag theory.

For applications where liquid-tightness is required such as floor slabs of storage tanks, the minimum thickness for uniform foundations shall be 5 inches and shall contain distributed reinforcing steel. The required area of such reinforcing steel shall be based on subgrade drag theory as discussed in industry guidelines such as American Concrete Institute, ACI 360, "Design of Slabs-on-Grade".

When heavy equipment loads are to be resisted and/or where a non-uniform foundation cannot be avoided, an appropriate design procedure incorporating a subgrade resistance parameter(s) such as ACI 360 shall be used.

If concrete is 4 inches thick, it must be placed on 6 mil perforated plastic or woven geotextile supported by 3 inches of ASTM C-33 No. 8 sand, or equivalent.

Minimum reinforcement for all floors shall be 8x8 gage, 6x6 inch welded wire fabric placed in the center of the slab.

<u>Additional Criteria for Holding Tanks</u>

Holding tanks are used for liquid and slurry waste and may be open or covered, within or outside of enclosed housing, or beneath slotted floors. Holding tanks shall be essentially watertight.

Holding tanks shall not be constructed of wood. Depending on the hazard involved to the environment, tanks shall be constructed of reinforced masonry, coated or glass-fused steel, or reinforced concrete. Tanks designed as buried structures shall have exterior drainage or a minimum safety factor of 1.3 against uplift, when empty.

Holding tanks shall be sufficiently watertight to retain liquids required for agitating and pumping and to function as planned. Effluent seepage in amounts that would pollute surface or ground water shall be prevented by watertight construction or collected and disposed of in a safe manner. Influent seepage in amounts that would infringe on the designed holding capacity

shall be prevented by watertight construction or site drainage.

The openings in covered holding tanks shall be designed to accommodate equipment for loading, agitating, and emptying, and shall have grills or secure covers for safety, odor, and insect control. Central loading from an elevation at or above the top of the sidewall of open holding tanks allows more complete and uniform filling, particularly with manure containing bedding. Steel and other corrodible materials shall be adequately protected with concrete, paint, or other protective coatings to prevent corrosion.

Additional Criteria for Manure Stacking Facilities

Stacking facilities may be open or roofed and are used for wastes which behave primarily as a solid. Facilities or structures for storage of slurry wastes shall be designed using criteria for holding tanks, or waste storage ponds. Facilities receiving 100 percent of the manure production, with no provision for liquid separation, shall not be designed as stacking facilities.

Stacking facilities shall be constructed of durable materials such as reinforced concrete, reinforced concrete block, or treated lumber. They shall be designed with adequate safety factors to prevent failure due to internal or external pressures, including hydrostatic uplift pressure and imposed surface loads such as equipment which may be used within, on, or adjacent to the structure. Lumber shall not be used for walls which support moving stacking elevators or similar loads.

Floors shall slope away from the entrance. Suggested grade of the floor is 0.2 or 0.3 percent.

Where concrete floors contact wood walls or posts, the concrete and wood shall be separated by 1/2-inch preformed bituminous expansion joint material. The expansion joint material is not required where wood walls rest on top of concrete and the resultant joint is horizontal.

Concrete block walls shall be designed and constructed in accordance with the West Virginia Supplement to Chapter 6 of the Engineering Field Handbook.

Timber may be of black locust, osage orange, red cedar, or redwood. All other timber shall be pressure-treated wood.

Posts shall have a minimum size of 6"x6" and be placed in the ground from 3- to 6-feet deep, depending on design criteria. Side planking shall be treated lumber with a minimum thickness of 2 inches.

Effluent seepage in amounts that would pollute surface or ground water shall be prevented by watertight construction or collected and disposed of in a safe manner. Influent seepage in amounts that would infringe on designed storage capacity shall be prevented by watertight construction or site drainage.

Drainage of some liquids, including rainfall from the stacking area (especially those without a roof), should be considered. This is best accomplished by use of a timber wall with the boards installed vertically, leaving 3/4-inch cracks. The timber wall drainage section may be included in a concrete or masonry block wall.

Design criteria shall be the same as for timber walls. Seepage shall be collected in a tank or waste storage pond, or properly treated in a lagoon or infiltration strip.

Considerations

Waste storage facilities should be located as close to the source of waste and polluted runoff as practicable.

Nonpolluted runoff should be excluded from the structure to the fullest extent possible except where its storage is advantageous to the operation of the agricultural waste management system.

Freeboard for waste storage structures should be considered.

Solid/liquid separation of runoff or wastewater entering pond facilities should be considered to

minimize the frequency of accumulated solid removal and to facilitate pumping and application of the stored waste.

Due consideration should be given to environmental concerns, economics, the overall waste management system plan, and safety and health factors.

Considerations for minimizing the potential for and impacts of sudden breach of embankment or accidental release from the required volume.

Features, safeguards, and/or management measures to minimize the risk of failure or accidental release, or to minimize or mitigate impact of this type of failure should be considered when any of the categories listed in Table 4 might be significantly affected.

The following should be considered either singly or in combination to minimize the potential of or the consequences of sudden breach of embankments when one or more of the potential impact categories listed in Table 4 may be significantly affected:

1. An auxiliary (emergency) spillway
2. Additional freeboard
3. Storage for wet year rather than normal year precipitation
4. Reinforced embankment -- such as, additional top width, flattened and/or armored downstream side slopes
5. Secondary containment

Table 4 - Potential Impact Categories from Breach of Embankment or Accidental Release

1. Surface water bodies -- perennial streams, lakes, wetlands, and estuaries
2. Critical habitat for threatened and endangered species.
3. Riparian areas
4. Farmstead, or other areas of habitation
5. Off-farm property
6. Historical and/or archaeological sites or structures that meet the eligibility criteria for listing in the National Register of Historical Places.

The following options should be considered to minimize the potential for accidental release from the required volume through gravity outlets when one or more of the potential impact categories listed in Table 4 may be significantly affected:

1. Outlet gate locks or locked gate housing
2. Secondary containment
3. Alarm system
4. Another means of emptying the required volume

Considerations for minimizing the potential of waste storage pond liner failure.

Sites with categories listed in Table 5 should be avoided unless no reasonable alternative exists. Under those circumstances, consideration should be given to providing an additional measure of safety from pond seepage when any of the potential impact categories listed in Table 5 may be significantly affected.

Table 5 - Potential Impact Categories for Liner Failure

1. Any underlying aquifer is at a shallow depth and not confined
2. The vadose zone is rock
3. The aquifer is a domestic water supply or ecologically vital water supply
4. The site is located in an area of solutionized bedrock such as limestone or gypsum.

Should any of the potential impact categories listed in Table 5 be affected, consideration should be given to the following:

1. A clay liner designed in accordance with procedures of AWMFH Appendix 10D with a thickness and coefficient of permeability so that specific discharge is less than 1×10^{-6} cm/sec
2. A flexible membrane liner over a clay liner
3. A geosynthetic clay liner (GCL) flexible membrane liner
4. A concrete liner designed in accordance with slabs on grade criteria for fabricated structures requiring water tightness

Considerations for minimizing the impact of odors.

An anaerobic lagoon instead of a waste storage pond should be considered for sites located in rural areas where odors are a concern. This should be especially considered where odors would affect neighboring farms having enterprises that do not cause odors and/or neighbors who earn a living off-farm. The recommended loading rate for anaerobic lagoons at sites where odors must be minimized is one-half the values given in AWMFH Figure 10-22.

For sites located near urban areas practices such as the following should be considered to reduce odor emissions:

1. Covering the storage facility with a suitable cover.
2. Using naturally aerated or mechanically aerated lagoons.
3. Using composting in conjunction with a solid waste system rather than a liquid or slurry system.
4. Using a methane digester and capture system.

Plans and Specifications

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use.

Specifications may be developed from NEH-20 Series, the 700 Series, or other applicable reference material.

Plans must show all pertinent features such as dimensions, location, and details of inlet and outlet structures.

Applicable West Virginia engineering standards and specifications will apply to components of the system.

All designs for animal waste disposal systems must be developed with assistance from an engineer.

Operation and Maintenance

An operation and maintenance plan shall be developed that is consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for its design.

The plan shall contain the operational requirements for emptying the storage facility. This shall include the requirement that waste shall be removed from storage and utilized at locations, times, rates, and volume in accordance with the overall waste management system plan. In addition, for ponds, the plan shall include an explanation of the permanent marker or recorder installed to indicate the maximum operating level. The plan shall include a strategy for removal and disposition of waste with least environmental damage during the normal storage period to the extent necessary to insure the pond's safe operation. This strategy is for the removal of the contribution of unusual

storm events that may cause the pond to fill to capacity prematurely with subsequent design inflow and usual precipitation prior to the end of the normal storage period. Development of an emergency action plan should be considered for waste storage facilities where there is a potential for significant impact from breach or accidental release. The plan shall include site-specific provisions for emergency actions that will minimize these impacts.

A management plan will be prepared by the NRCS conservationist for the operator to follow using the guidelines in Chapter 18 of the Agricultural Waste Management Field Handbook and the following:

<u>Waste Storage Pond</u>

Remove solids from settling basins at frequent intervals to maintain storage.

Mosquito breeding can be controlled by adding larvacides.

Agitation of gravity unloading systems for slurry waste is required to facilitate complete unloading of the structure.

Additional water may be required to dilute slurries in order to pump the waste through an irrigation system.

<u>Holding Tank</u>

Where tanks are located in buildings, provisions shall be made to provide adequate ventilation, especially during agitation and pumping.

Spreader tanks should be equipped with flotation tires to reduce soil compaction.

Avoid scraping frozen or dry manure into the tank.

Sand, gravel, or other abrasive material should be kept out of the system.

Once agitation is started, the tank should be emptied.

The tank shall be emptied promptly when the design level is reached.

Cleanouts will be scheduled to have the structure empty prior to the start of the design storage period.

Prior to filling the tank with manure, 6 to 12 inches of water should be placed in the bottom to prevent manure from adhering.

<u>Manure Stacking Facility</u>

Mosquitoes and flies will be controlled by use of a larvacide.

Livestock shall be fenced out of the facility.

The structures shall be emptied promptly when the design level is reached.

Cleanouts will be scheduled to have the structure empty prior to the start of the design storage period.

Drain slots in timber walls will be inspected regularly and cleaned to permit good drainage.

[1]Bold italics is information added to the National standard by West Virginia.